

PEACH FLOWER BUD THINNING BY DORMANT SEASON APPLICATIONS OF ETHEPHON PLUS VEGETOIL[®]

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ABSTRACT

Removal of flower buds, flowers or small fruitlets significantly increases peach fruit size at harvest. Due to the lack of labeled or consistent thinning chemicals, peach growers wait ~30 days after full bloom when fruit set is obvious before hand-thinning fruit, which limits potential fruit size. Experiments were conducted near Clemson, South Carolina to determine the efficacy of combining Vegetoil[®] (VO), an emulsified soybean oil adjuvant (93% soybean oil), with Ethrel[®] (a.i. 21.7% ethephon) for pre-bloom thinning of peach cultivars. 'Contender' in February 2005 and 'Contender', 'Cresthaven' and 'Rubyprince' in January 2006 were sprayed with 10% VO except for 'Rubyprince' (8% VO). Ethephon concentrations were 50, 100, or 150 ppm. Dormant oil at 3% was the control treatment. VO (10%) plus ethephon at 100 and 150 ppm significantly delayed bloom in 'Contender' and 'Cresthaven' in 2006. VO (10%) significantly reduced the number of live flower buds at bloom for these two cultivars, but 8% VO did not significantly affect 'Rubyprince' flower bud survival. The addition of Ethrel[®] to the VO spray significantly reduced live flower bud numbers at bloom versus just the VO treatment for 'Contender' and 'Cresthaven', but there were no differences observed among the 'Rubyprince' treatments. Generally, 'Rubyprince' is easier to thin with soybean oil than 'Cresthaven', but the opposite was observed in this study. Chill hour accumulation and temperature at application and VO rates may have differentially influenced cultivar flower bud sensitivity to VO and Ethrel[®].

INTRODUCTION

Thinning is necessary to adjust the number of fruits on the tree so that they will adequately size for commercial acceptance. Thinning practices that achieve a marketable fruit size that maximizes pack out yield per tree would increase orchard production efficiency for growers. An important component of maximizing fruit size and yield is time of thinning (Day and DeJong, 1999). This can be done pre-bloom (floral buds), during bloom (flowers), or post-bloom (fruitlets). Yield and fruit size may be increased if thinning is performed before or at bloom, compared with the typical commercial timing of 50 days after full bloom (Stover, 2000). Dormant applications of soybean oil kills weak flower buds and can potentially reduce early competition between flower buds (Myers et al., 1996; Moran et al., 2000). Early thinning is desirable for maximum fruit size but current early thinning options and their benefits are not always reliable or predictable. Therefore, thinning is carried out in a timely but conservative manner (before pit hardening, but later than ideal). Labor logistics and a cultivar's potential fruit size often determine when hand-thinning gets started in large commercial orchards. Implementing partial early thinning with chemicals like ethephon and/or vegetable oils such as soybean oil will reduce follow-up hand-thinning costs, avoid over-thinning due to frost or fruit

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drop events, and increase ultimate fruit size compared to the one-time thinning approach currently done late in the thinning time window.

Spring freeze events have significantly affected South Carolina's and the Southeast's peach production in the 1980s, 1990s, 2001, and 2002. Despite the cold weather, some late blooming peach cultivars have cropped in severe freeze years. Any delay in flowering retards the bud dehardening process in peach and improves cropping in freeze years. Thus, induced flower delay in peach can reduce flower damage from spring freezes. Soybean oil sprayed during the dormant season at specific times has slowed phenological bud development in peach during spring bloom. The objective of this study was to develop an economical, cost-saving, early partial thinning method using soybean oil, alone or in combination with ethephon, as a dormant oil spray.

MATERIALS AND METHODS

Ten-year-old trees of 'Contender' peach (*Prunus persica* (L.) Batsch), 10-year-old trees of 'Cresthaven' peach, and 8-year-old trees of 'Rubyprince' peach located at the Musser Fruit Research Center near Clemson, SC were used. 'Cresthaven' trees were sprayed January 10, 2006 (at 780 chill hours) and 'Contender' trees were sprayed January 26, 2006 (at 930 chill hours) with 3% dormant oil (i.e., control treatment), 10% Vegetoil® (a.i. 93% soybean oil), 10% Vegetoil® plus 100 ppm ethephon (Ethrel® with a.i. 21.7% ethephon), or 10% Vegetoil® plus 150 ppm ethephon. 'Rubyprince' trees were sprayed January 10, 2006 (at 780 chill hours) with 3% dormant oil (= control), 8% Vegetoil®, 8% Vegetoil® plus 50 ppm ethephon, 8% Vegetoil® plus 100 ppm ethephon, or 8% Vegetoil® plus 150 ppm ethephon.

In 2005, the same 'Contender' trees (9-years-old) were sprayed February 1, 2005 at 875 chill hours with 3% dormant oil (control), 10% Vegetoil®, or 10% Vegetoil® plus 100ppm ethephon (Ethrel®). A routine 3% dormant oil (DO) spray was applied in early December, 2004. All treatments were applied with an airblast sprayer calibrated at 135 GPA (1262 L/ha).

Spray treatments in 2006 consisted of 75.7 L (20 gal.) of spray solution for the 8 trees in each treatment, with ~ 7.6 L (2 gals.) of spray per tree. All treatments were hand-gun sprayed to drip on all sides of the tree via a 5 horsepower, gasoline-powered engine with a 2-piston pump. Trees were also sprayed earlier with 3% dormant oil (DO) December 6, 2005 with an airblast sprayer calibrated to deliver 150 gallons per acre (GPA) or 1402 L/ha. Treatments were arranged in a randomized complete block design with 4 reps, each consisting of four or five 2-tree plots. Guard trees were situated between plots to impede drift. All trees were trained to an open-center system. Daily January temperatures and chill hour accumulation were recorded (data not shown).

Prior to treatment on February 1, 2005, six 1-year-old shoots were randomly selected from each 'Contender' tree and tagged. Shoot length and number of flower buds on each shoot were determined at this time. In mid-March, the number of live flower buds on each shoot was recorded to determine flower bud survival rate. The number of open flowers was recorded twice from March 18-28 to determine the percentage of flower buds open at each date. Date of full bloom (90% flowers open) for each tree was recorded.

Prior to each spray treatment in January 2006, ten 1-year-old shoots were randomly selected from each tree and tagged. For these 2006 treatments, the mid-point of five (of ten) shoots on each tree was marked, dividing their length into a basal half and a terminal half. Shoot length and number of flower buds on each shoot (and half-shoot) were determined at this time. In mid-March, the number of live flower buds on each shoot (and half-shoot) was recorded to determine flower bud survival rate. The number of open flowers was recorded twice from March 9-17 to determine the percentage of flower buds open at each date. Date of full bloom (90% flowers open) for each tree was recorded.

RESULTS AND DISCUSSION

Timing of bloom in the 'Contender' orchard was similar across treatments in 2005 (Table 1). VO and VO plus Ethrel® treatments reduced flower bud survival 23% and 48%, respectively, compared to the DO control; however, both VO treatments had the same number of fruit set per flower (Table 1). The lower flower survival led to a reduction in fruit set, and consequently, 60-80% fewer fruitlets removed by hand-thinning in early May. VO and VO plus Ethrel® advanced fruit maturity ~ 1 day (Table 2). The large reduction in fruit set resulted in a 30-45% reduction in fruit yield and a 15-25% increase in fruit size.

Vegetoil® (10%) plus Ethrel® at 100 and 150 ppm ethephon significantly delayed bloom in 'Contender' and 'Cresthaven' in 2006 (Tables 3 & 4). VO (10%) significantly reduced the number of live flower buds at bloom for these two cultivars, but 8% VO did not significantly affect 'Rubyprince' flower bud survival (Table 5). The addition of Ethrel® to the VO spray significantly reduced live flower bud numbers at bloom versus just the VO treatment for 'Contender' and 'Cresthaven', but there were no differences observed among the 'Rubyprince' treatments. The basal half of shoot flowers had significantly lower survival in 'Contender' and 'Rubyprince'.

Generally, 'Rubyprince' is easier to thin with soybean oil than 'Cresthaven', but the opposite was observed in this study. The different effects of dormant Vegetoil® sprays with and without ethephon for 'Contender' between years and among the three cultivars in 2006 indicate that (1) chill hour accumulation and temperature at application and (2) the Vegetoil® concentration may have differentially influenced cultivar flower bud sensitivity to VO and Ethrel®.

ACKNOWLEDGEMENTS

The authors thank the South Carolina Peach Council for funding and Xioayu Liu and Ginger Swire-Clark for technical assistance.

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Table 1. Contender 2005 flowering and fruit set data at Musser Fruit Research Center, Clemson, SC.

Cultivar	Treatment	Full bloom ^z (Julian date)	Flower bud	No. set fruit		Thinned
			survival (%) 3/24/05	per shoot 5/3/05	per flower 5/3/05	fruitlets (No./tree) 5/3/05
Contender	3% DO, 875 chill hrs	88.0 b	86.8 a	12.3 a	0.75 a	2395 a
	10% VO, 875 chill hrs	88.6 a	66.7 b	5.0 b	0.45 b	921 b
	10%VO + 100ppm ethephon, 875 chill hrs	88.9 a	45.1 c	3.4 c	0.46 b	462 b

^z Mean separation within columns by Duncan's multiple range test, p< 0.05.

Table 2. Contender 2005 harvest data at Musser Fruit Research Center, Clemson, SC.

Cultivar	Treatment	10% ripe ^z (Julian date)	Mean fruit	Total fruit	Yield
			weight (g)	yield (kg)	efficiency (kg/cm ²)
Contender	3% DO, 875 chill hrs	200.9 a	214 c	114.8 a	0.40 a
	10% VO, 875 chill hrs	200.1 b	251 b	80.4 b	0.31 b
	10%VO + 100ppm ethephon, 875 chill hrs	200.1 b	269 a	65.9 b	0.24 b

^z Mean separation within columns by Duncan's multiple range test, p< 0.05.

Table 3. Contender 2006 flowering data at Musser Fruit Research Center, Clemson, SC.

Cultivar	Treatment	% flower buds open ^z		Full bloom (Julian date)	Flower bud survival (%) 3/15/06
		3/13/06	3/17/06		
Contender	3% DO	21.4 a	85.0 a	75.1 c	87.6 a
	10% VO	20.8 a	70.9 b	75.8 b	63.7 b
	10% VO + 100 ppm ethephon	11.5 b	62.4 bc	76.4 a	43.4 c
	10% VO + 150 ppm ethephon	10.0 b	59.5 c	76.4 a	30.7 d
	basal half	10.6 b	66.1 b		51.6 b
	terminal half	24.9 a	78.3 a		62.2 a

^z Mean separation within columns by Duncan's multiple range test, p< 0.05.

Table 4. Cresthaven 2006 flowering data at Musser Fruit Research Center, Clemson, SC.

Cultivar	Treatment	% flower buds open ^z		Full bloom (Julian date)	Flower bud survival (%) 3/13/06
		3/13/06	3/15/06		
Cresthaven	3% DO	44.9 a	75.2 a	74.3 c	95.0 a
	10% VO	37.5 b	56.6 b	75.3 b	86.8 b
	10% VO + 100 ppm ethephon	24.7 c	47.7 c	76.5 a	60.2 c
	10% VO + 150 ppm ethephon	19.5 c	35.3 d	76.9 a	42.8 d
	basal half	17.5 b	38.6 b		69.4 a
	terminal half	46.4 a	68.3 a		73.9 a

^z Mean separation within columns by Duncan's multiple range test, p< 0.05.

Table 5. Rubyprince 2006 flowering data at Musser Fruit Research Center, Clemson, SC.

Cultivar	Treatment	% flower buds open ^z		Full bloom (Julian date)	Flower bud survival (%) 3/9/06
		3/9/06	3/13/06		
Rubyprince	3% DO	6.3 a	46.1 b	72.0 a	87.1 ab
	8% VO	7.3 a	57.4 a	71.3 b	89.7 a
	8% VO + 50 ppm ethephon	6.0 a	52.9 ab	71.5 ab	87.0 ab
	8% VO + 100 ppm ethephon	5.4 a	50.9 ab	71.8 ab	82.7 b
	8% VO + 150 ppm ethephon	2.0 b	47.4 b	71.6 ab	86.4 ab
	basal half	0.3 b	30.0 b		80.5 b
	terminal half	9.3 a	71.3 a		86.7 a

^z Mean separation within columns by Duncan's multiple range test, p< 0.05.